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Postnatal Depression and Faltering Growth: A Community Study

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ABSTRACT. *Objective.* To investigate the association between faltering growth in children and maternal postnatal depression.

Methods. Children aged ≤ 2 years were identified from community child health surveillance records if their weights fell across 2 centile channels on standardized growth charts or fell below the second centile. Mothers of these index children were invited to complete the Edinburgh Postnatal Depression Scale and the anxiety subscale of the Hospital Anxiety and Depression Scale. Those who scored above threshold values on either scale were interviewed with the revised Clinical Interview Schedule. Matched control children were obtained from health visitor records, and records of their weights were obtained. Mothers of control children completed the same questionnaires.

Results. A total of 196 index children and 567 control children were studied. Significantly more mothers in the index group scored above the threshold for both the Edinburgh Postnatal Depression Scale (33% vs 22%; odds ratio [OR]: 1.71; 95% confidence interval [CI]: 1.16-2.53) and the Hospital Anxiety and Depression Scale (24% vs 13%; OR: 2.08; 95% CI: 1.33-3.25) questionnaires. Furthermore, clinical interviews with these mothers demonstrated that 21% of the index group and 11% of the control group fulfilled criteria for depressive episode (OR: 1.88; 95% CI: 1.21-2.94).

Conclusions. Depression in mothers of children with faltering growth during the first 2 years of life is significantly greater than in mothers of children who are gaining weight appropriately. In view of the high rates of maternal depression in children with poor weight gain, clinical management at presentation of either problem should focus on both members of the mother-child dyad and on the interaction between mother and child. These findings have implications for all professionals who work in primary and secondary health care. *Pediatrics* 2004; 113:1242-1247; *postnatal depression, faltering growth, failure to thrive.*

ABBREVIATIONS. FTT, failure to thrive; PND, postnatal depression; EPDS, Edinburgh Postnatal Depression Scale; HADS, Hospital Anxiety and Depression Scale; CIS-R, Revised Clinical Interview Schedule; OR, odds ratios; CI, confidence interval.

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Faltering growth and failure to thrive are overlapping descriptive terms applied to children who have poor weight gain compared with standard growth rates. Despite there being no consistent definition for identification of failure to thrive (FTT),^{1,2} a fall across 2 centile channels or a fall beneath the second centile on standardized growth charts for at least 3 months (to exclude weight loss secondary to an acute illness) are well-established criteria for identification of FTT. The incidence of FTT is reported to be between 1% and 10% during the first 2 years of life,³⁻⁵ and the major cause is undernutrition. The term "faltering growth" has similar recognition criteria to FTT but has less implication of severity or persistence, covering the spectrum of children with a transient problem in weight gain in addition to those with more persistent problems.

The majority of children with faltering growth are never referred to a hospital; ~5% may be admitted to a hospital, and, of these, ~5% may be found to have an organic component to their poor growth.⁶ As such, it is well accepted that FTT has a predominantly nutritional cause.⁷ The reasons underlying poor nutrition in children include interactive problems between the parent and the child, and observations of children who are hospitalized for poor weight gain indicate that, for some, there is a chaotic family background or unusual mother-child interaction.⁸⁻¹⁰ Children in these hospital cohorts, however, are a select group and are not representative of the heterogeneous spectrum found in community samples.¹¹

Postnatal depression (PND) is a serious disorder that affects ~10% to 13% of childbearing women^{12,13} and has a deleterious effect on parenting capacities, which subsequently affects the cognitive and emotional development of infants and older children.¹⁴⁻¹⁹ Although there have been many studies on maternal depression and its impact on infant behavior, child growth has rarely been taken into account. Previous observation of mothers of children with FTT gives conflicting evidence as to whether they seem more depressed.²⁰⁻²⁶ Several studies have hinted that observations of mothers whose children have FTT seem more depressed,²¹⁻²³ although this association has not been formally addressed. The Edinburgh Postnatal Depression Scale (EPDS), a 10-item scale developed to assist primary care practitioners in the detection of PND, is a well-validated screening tool with good sensitivity and specificity.²⁷ Thus, the EPDS provides an easy and reliable way of screening for PND in large community surveys.

We therefore conducted a case-control study to investigate the relationship of faltering growth and PND in a community sample of mothers and children. This design addressed the methodologic issues of small sample size^{9,10} and skewed populations, such as hospital-based samples,⁸⁻¹⁰ observed in previous studies. The county of North Staffordshire in the United Kingdom, population ~0.5 million, was ideally suited to this study because all health visitors (community-based registered nurses with a public health role and specialist training in child health and development) are trained to administer routinely the EPDS. In addition, the region has a parent and infant day unit specifically for women who have PND.²⁸

METHODS

All children in the United Kingdom are routinely weighed during the first few years of life as part of the community child health surveillance program, and weights are recorded in the Parent Held Child Health Record booklet given to all mothers. Recruitment of children and their mothers was undertaken through this child health surveillance program. This project was approved by the Local Research Ethics Committee, and all participants gave written consent to participate in the study.

Posters and information leaflets were displayed in family health clinics across the region. The research team was accessible to the health visitors for the duration of the study, and periodic meetings were held so that any concerns could be addressed. In addition, L.M.O. visited all health clinics and personally met with all health visitors to ensure that study criteria were adhered to and to address further any individual apprehensions.

Identification of Children

All health visitors who worked in North Staffordshire between October 1997 and April 1999 were requested to refer children under the age of 2 years, with the consent of their parents, to this study if they were identified during community child health surveillance as having serial weights that crossed 2 major centiles on standardized growth charts or fell below the second centile. Mothers of these index children were contacted by telephone (or mail in the case of those without telephones) and invited to participate. Control children were identified from the district child health computer system and were matched as closely as possible for age, gender, ordinal position, and postal code. Letters were sent to mothers of control children with an invitation to participate and a reply slip. To recruit 3 control children for each index child, letters were mailed to 6 control children per index child. Mothers who responded positively were contacted by telephone (or by mail in the case of those without telephones). All women who agreed to participate were visited at home by L.M.O. Children were excluded when they had been born prematurely or were small for gestational age, as this affects their growth pattern, and when they had non-English-speaking mothers because the EPDS has not yet been validated in some other language groups in the United Kingdom.

Home Visits

Children and mothers who were recruited into the study were visited at home, and all previous data on child growth were collected from their Parent Held Child Health Record booklets. Weights of children who were identified during routine child health surveillance and referred into the study were replotted on standardized growth charts, and those who did not fit selection criteria were excluded. Weights of control children were also plotted on standardized charts. Demographic data on these mother-child dyads were collected, including postal code, which was used to define deprivation by electoral ward using the Jarman score.²⁹

During the home visit, all mothers were asked to complete the EPDS and the anxiety subscale of the Hospital Anxiety and Depression Scale (HADS). These both are well-validated screening tools for depression and anxiety, respectively.^{27,30} Clinically, the threshold value for the EPDS is ≥ 13 , although a score of ≥ 9 is

generally suggested for research screening purposes.³¹ Maternal depression and anxiety was measured using accepted thresholds of ≥ 9 on the EPDS and/or ≥ 8 on the anxiety subscale of HADS, respectively. Women who scored above these recognized values on the screening scales, together with a random sample of 5% of women who scored below the threshold values, were interviewed with the Revised Clinical Interview Schedule (CIS-R), a structured interviewer-administered questionnaire used for the diagnosis of depressive episode.³² This interview was given immediately after the screening with the EPDS and was conducted by a single observer (L.M.O.).

L.M.O. was trained in the use of the CIS-R at the Institute of Psychiatry (London, UK). These structured interviews were subsequently assessed by a psychiatrist (M.H.) who was blind to the mother and child group, and *International Classification of Diseases, 10th Revision* diagnoses of depressive episode were derived. When possible, follow-up weights were gained from the index children at least 3 months after the initial visit to obtain a measure of persistence of poor weight gain.

To minimize potential referral biases, health visitors were requested to provide anonymous EPDS scores of women whose children had fulfilled criteria for entry to the study but whom they had not referred.

Sample Size Estimate

For demonstrating a difference of 10% in rates of PND between the 2 groups of women with 5% significance and 80% power, a minimum of 137 children and their mothers were required, together with at least 412 in the control group (a ratio of 1:3) because control children were easier to obtain.

Data Analysis

Data were analyzed using SPSS version 9.0 (SPSS Inc, Chicago, IL) and checked by double entry. An acceptable error rate of 0.13% was found. χ^2 tests were used to test categorical variables between the 2 groups, *t* tests were used for continuous data, and Wilcoxon rank sum test was used for ordinal data; logistic regression, with index/control as the dependent variable, was used to correct the *P* value for the association of depression and faltering growth for variables that showed significant difference for index and control groups. Corrected odds ratios (ORs) and 95% confidence intervals (CIs) are presented.

RESULTS

Health professionals referred a total of 180 children into the study (Fig 1). Altogether, 28 refused to take part and 17 were excluded as they did not fit the recruitment criteria. A total of 1338 control families were contacted, and 839 (63%) responded. Of the 839 responders, 696 (83%) initially agreed to take part but 41 of these either changed their minds or avoided subsequent contact. Of these remaining 655 families, 88 (13%) children were excluded for a variety of reasons: <37 weeks' gestation ($n = 1$), less than second centile at birth ($n = 12$), >2 years at time of visit ($n = 11$), no weights available at visit ($n = 3$), and fitted criteria for faltering growth ($n = 61$). These last 61 children (9% of the control group) were subsequently placed into the index group. Results therefore were obtained from 196 index and 567 control mothers and children.

Demographic information for each group is shown in Table 1. Data are presented as mean \pm standard deviation unless otherwise indicated.

Birth weight and ordinal position were similarly distributed in each group despite statistical significance between the index and control children. This was mainly attributable to the small standard deviations and large sample sizes; however, these differences are not considered to be clinically meaningful.

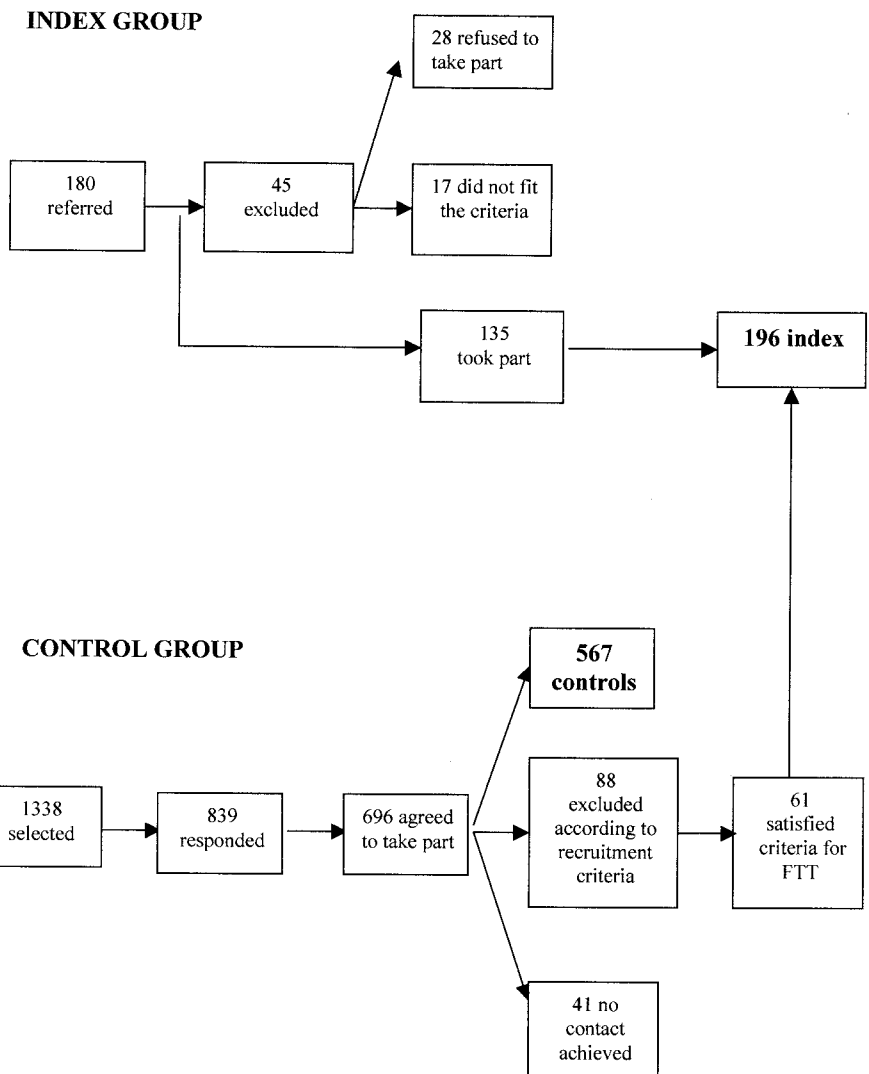


Fig. 1. Flow diagram illustrating the recruitment process.

TABLE 1. Demographic Information for 196 Index and 567 Control Mothers and Children

	Index (n = 196)	Control (n = 567)
Birth weight, kg	3.6 ± 0.5* (2.5–5.0)	3.4 ± 0.5 (2.5–5.0)
Ordinal position	2.1 ± 1.0* (1–6)	1.8 ± 0.8 (1–5)
Age at visit, mo	7.7 ± 5.3* (1.2–24.8)	10.1 ± 5.3 (1.3–25.9)
Male, %	35.2	41.6
Single parent, %	12.8	12.0
Maternal age, y	28.1 ± 5.4† (17.0–44.0)	29.5 ± 5.3 (16.8–47.2)
Neonatal deaths, %	2.0	0.5
Jarman score	12.4 ± 14.2 (–27.8–+38.5)	11.3 ± 14.2 (–33.3–+38.5)

Data are shown as mean ± standard deviation unless otherwise indicated.

* $P \leq .001$.

† $P \leq .01$.

Mothers of control children were significantly younger than mothers of index children, although, in reality, the median difference of a little more than 1 year is unlikely to be of any relevance. Indeed, the range of maternal age in each group was very simi-

lar. Control children were significantly older than index children at the time of visit. Nonetheless, all statistics reported are corrected for these imbalances.

Results of the screening questionnaires are shown in Table 2. Significantly more women in the index group scored above the thresholds of both the EPDS and the HADS than women in the control group: EPDS ≥ 9 (OR: 1.71; 95% CI: 1.16–2.53; $P = .007$ adjusted); EPDS ≥ 13 (OR: 1.96; 95% CI: 1.13–3.38; $P = .016$ adjusted); anxiety subscale of the HADS (OR: 2.08; 95% CI: 1.33–3.25; $P = .001$ adjusted).

Using the *International Classification of Diseases, 10th Revision* diagnosis of depressive episode, the results of the diagnostic questionnaire, corrected for uptake rate, confirm the marked difference between index and control mothers (Table 3). Ninety-one percent of the women in the index group and 90% of women in the control group who scored above the threshold for either screening questionnaire agreed to be interviewed with the CIS-R. Depressive episode was present in 21.4% of index mothers compared with 11.1% of control mothers (OR: 1.88; 95% CI: 1.21–2.94; $P = .005$ adjusted).

A random subsample of 6% ($n = 33$) of women with scores below the threshold values on the screen-

TABLE 2. Results of the Screening Questionnaires for 196 Index and 567 Control Mothers

	Index (<i>n</i> = 196; <i>N</i> [%])	Control (<i>n</i> = 567; <i>N</i> [%])	OR (95% CI)
EPDS ≥ 9	64 (32.7%)	122 (21.5%)	1.71† (1.16–2.53)
EPDS $\geq 13^*$	29 (14.8%)	44 (7.8%)	1.96‡ (1.13–3.38)
Anxiety subscale of HADS ≥ 8	47 (24.0%)	73 (12.9%)	2.08† (1.33–3.25)
No. of women scoring EPDS ≥ 9 or anxiety subscale of HADS ≥ 8	69 (35.2%)	134 (23.6%)	1.74† (1.19–2.54)

* EPDS threshold of ≥ 13 is illustrated because this is the accepted clinical value for screening purposes without the use of the CIS-R.

† $P \leq .01$; ‡ $P \leq .02$ adjusted for covariates.

TABLE 3. Results of the Diagnostic Interview for 196 Index and 567 Control Mothers

	Index (<i>n</i> = 196)	Control (<i>n</i> = 567)	OR (95% CI)
No. of women scoring above the thresholds who were interviewed (% of total sample)	63 (32.1%)	120 (21.2%)	
No. of women scoring above the thresholds who were depressed* (% of total sample)	42 (21.4%)	63 (11.1%)	1.88 (1.21–2.94)†

* Corrected for uptake rates of the CIS-R.

† $P \leq .01$.

ing questionnaires were interviewed with the CIS-R. The results of these interviews found a depressive episode in 1 (11.1%) of 9 index mothers and in 1 (4.2%) of 24 control mothers with low scores on the screening questionnaires.

The increase in frequency of depression remains when analysis is restricted to mothers who had an infant <6 months of age. There is no evident link between infant birth weight or ordinal position and maternal depression.

Health visitors did not refer 20 children who had severe FTT. Nineteen mothers of these children had scored above threshold values on routine screening for PND with the EPDS and were receiving treatment for depression, and the remaining family was involved in a child protection case.

Three months after visiting children with faltering growth, we were able to obtain follow-up weights for 180 of the 196 children (92% of the index group). A total of 102 children had persistent faltering growth, with the weight of the remaining 78 either improving or settling on a new centile. There was no significant difference in the rates of depression at the time of the visit between those with transient and persistent poor weight gain (rates of depressive episodes were 21.8% and 23.5%, respectively). However, no measure of depression was obtained at these follow-up contacts.

DISCUSSION

The major finding of this study is that mothers of children with faltering growth have a significantly increased risk of postnatal depression and anxiety than mothers of children who are gaining weight as expected. To our knowledge, this is the first large-scale community study to focus entirely on infants with faltering growth and the mental health of their mothers, and the findings are of considerable clinical relevance to health service provision at both primary and secondary health care levels. We have found that mothers of children with poor weight gain have al-

most twice the risk of depressive illness even after adjustment for other covariates.

The rates of depression in our control group reflect those found in other epidemiologic studies,^{12,33–36} and this is additional confirmation that the women in our control sample are representative of the general population. However, clinical interviews obtained from a small number of women with low scores on the screening questionnaires found that several of these women also fulfilled criteria for depressive episode. This is not unexpected because this group included women with very low scores on the EPDS, and this in itself may be suspicious in some women.²⁷ Furthermore, these results strengthen our findings because low-scoring mothers of index children were still more likely to be depressed than low-scoring mothers of control children. Although we were unable to interview every mother with the CIS-R because of logistic issues, these results suggest that our findings were unlikely to have been influenced by missing depressed women who scored low on the screening questionnaires.

Maternal depression is known to affect mother-child interaction, particularly infant emotional and cognitive development,^{14–16,18,23} which could exacerbate feeding difficulties and affect child growth. A recent study by Ramsey et al²⁶ suggested that maternal PND did not affect infant growth. However, this study was not designed to examine the relationship between these 2 variables; rather, it was a prospective study of the relationship of infant suckling to later feeding, infant growth, and maternal PND. Although the overall sample size was relatively large ($N = 409$), only 18 children could have been considered as having faltering growth. In addition, the faltering growth group was identified at the age of 10 months, but the authors used EPDS scores obtained at 1 week and 2 months of age to relate PND to growth. Thus, their conclusion is not supported by strong data and does not address whether growth faltering could be transient in the presence of PND.

Because serial weights and EPDS scores were obtained on these mother–infant pairs, this issue could have been investigated. Our study identified children with faltering growth and obtained EPDS scores from the same time frame. We were able to ascertain that more than half of our index sample showed persistent poor weight gain for at least 3 months, although we did not obtain additional EPDS scores at that time. Had we obtained EPDS scores at that time, we could have addressed whether improvement in maternal mental health is associated with transient faltering growth.

One limitation of the present study was the potential for health visitors to refer preferentially children whose mothers were depressed, because they were aware of the study hypothesis. Health visitors therefore were asked whether they had children on their caseload that fit the criteria but were not referred, together with the reasons for nonreferral. In total, 20 children had not been referred, and in the majority of cases (95%), the main reason cited was severe maternal depression. It seems that health visitors were actually shielding their clients, which suggests that the association between faltering growth and maternal depression may well be even stronger than is reported here.

The finding that 61 of the children who were recruited as controls had weight gain patterns that fit the criteria for faltering growth was interesting. As this was a community study and our sample group was large, we are satisfied that this should not have biased our findings. It may also reflect community surveillance practices, because although these criteria for FTT are well described, it is known that only 5% to 10% of these children are referred to a hospital.⁶ Health visitors may follow up many of these children with serial weights, although they are not routinely referred. In addition, the weight of very large children will regress to the mean, and although they may cross several centile channels, concern about weight in these children is often not expressed. We did not find referral patterns of children with faltering growth to be predominantly from a small number of health centers in more affluent areas of North Staffordshire, and we therefore are satisfied that the children who were referred to the study were representative of all socioeconomic backgrounds. This is further supported by the similar Jarman scores for each group.

It could be argued that an additional limitation of the study was the response rate of the control families. We did achieve a response rate of 63% to a mailed invitation, and 95% of these families were visited. Because this was a postal contact in the first instance, we are satisfied that this represents a good response rate. The large number of women in the control group and the finding that these women had similar rates of depression when using the clinical threshold of ≥ 13 on the EPDS scale than other epidemiologic studies^{12,13,33} suggest that our control sample was indeed representative of the general population. We did not have access to routine EPDS scores of women who declined to participate in the control group. However, even if the prevalence of

depression were as high as 30% in these women, which is extremely unlikely, significant differences in the rate of PND would remain between the control group and the index group. This further supports the association between poor weight gain in infants and maternal PND.

This study was not designed to establish causality. However, all primary and secondary health care staff who care for women and children need to be aware of this strong association. Current management of both of these clinical conditions largely focuses on one or the other of the dyad and in some cases each independently. We recommend that future management of either condition be considered within the context of the mother–child dyad rather than the individual. It is possible that the current practice of repeat weighing of children with FTT, accompanied by the negative descriptive term used, contributes to anxiety and depression in the mother. Indeed, many of the women in this study reported that they felt failure when their infant was not gaining weight and their feelings of inadequacy increased when the emphasis was placed on weekly weights rather than on time spent discussing any underlying difficulties. Some women even reported that they avoided attending clinic sessions in case their child had not put on any weight. In the study by Ramsey et al,²⁶ they reported that “our results suggest a need for caution before blaming the mother when assessing growth failure.” Clearly, the use of such terminology only serves to contribute to the inadequacy felt by many mothers. However, it is also possible that poor infant growth could be one of the consequences of the detrimental effects of PND on parenting abilities. Indeed, a recent study from an Indian population that used a translated version of the EPDS suggested that PND may be a cause of poor infant growth.³⁷ This study found that maternal PND at 6 to 8 weeks after birth was strongly associated with being underweight at 6 months of age, even after adjustment for other determinants of infant growth. Additional research in this area is clearly required before causality can be established.

The findings of our study suggest that a child who is identified with poor weight gain should be treated clinically as part of the mother–child dyad, and the mother should be screened for PND. Community pediatricians therefore should have adequate training in the identification of mental disorder in the community and should work in collaboration with a community psychiatric nurse or a perinatal mental health team. Similarly, the child of a mother who presents with PND should have weight gain checked. The treatment of a depressed mother does not always include assessment of her interaction with her child, which we believe is vital to the well-being of mother–child dyads.

The ongoing management of both faltering growth in the child and depression in the mother needs to emphasize supervision and advice on feeding with reinforcement of positive parenting skills rather than repeat weight measurements. Although we are not able to determine that poor parenting skills are a mechanism for poor weight gain from the findings of

this study, it does seem possible. The term “failure to thrive” may indicate to a depressed mother that she is unable to carry out one of her main responsibilities, that is feeding her child adequately, and its routine use therefore should be questioned.

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